

ANNUAL REPORT FOR 2002



Pembroke Creek Mitigation Site
Chowan County
Project No. 8.T010602
TIP No. R-2512



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SUMMARY

The following report summarizes the monitoring activities that have occurred in the past year at the Pembroke Mitigation Site. The Pembroke Creek Mitigation Site in Chowan County is a bottomland forest site divided into two areas. The site was constructed to mitigate for the wetland impacts from the improvements to US 17 in Bertie and Chowan Counties (R-2512). In order to demonstrate successful mitigation, hydrologic and vegetative monitoring must be conducted for a minimum of five years or until success criteria are fulfilled. Site construction began in 1998 and was finished in 1999. The year 2002 represents the fourth year for hydrology and vegetation monitoring.

Hydrologic success for this site is based on the mean depth to groundwater of the gauges in the restoration area within 20% of the mean depth to groundwater of the gauges in the respective reference area. The hydrologic results indicated that the site met both jurisdictional success (i.e., the site was saturated within 12 inches of the surface for at least 12.5% of the growing season) as well as that dictated in the original plan. Only one of the four gauges did not show a saturation period within 20% of the reference gauges. This same gauge was the only one on the site that did not show saturation through the entire growing season.

Vegetation monitoring indicated that the site has successful tree growth. The average tree survival over all three planting zones was 543 trees per acre, with the exact zone breakdown as follows: 493 trees per acre for Zone 1, 634 trees per acre for Zone 2, and 503 trees per acre for Zone 3. Each of the individual zones, as well as the overall site average, is well above the requirement of 320 stems per acre.

Based on the results from the 2002 growing season, NCDOT will continue both hydrologic and vegetation monitoring.

1.0 INTRODUCTION

1.1 Project Description

The site is located adjacent to US 17 in Chowan County (Figure 1). Designed as a bottomland forest, the site was constructed to offset impacts of the improvements to US 17 in Bertie and Chowan Counties (R-2512).

1.2 Purpose

In order to demonstrate successful mitigation, hydrologic, and vegetative monitoring must be conducted for a minimum of five years. The following report details the results of hydrologic and vegetation monitoring during the 2002 growing season at the Pembroke Creek Mitigation Site. Included in this report are analyses of both hydrologic and vegetative monitoring results as gauge as local climate conditions throughout the growing season. The vegetation planted represents both Phase I and Phase 2 of the project's construction.

1.3 Project History

November 1997	Site Constructed (Phase I)
January 1998	Site Planted (Phase I)
October 1998	Vegetation Monitoring (1 yr.) (Phase I)
November 1998	Site Constructed (Phase II)
February 1999	Monitoring Gauges Installed
March-December 1999	Hydrologic Monitoring (1 yr.)
March 1999	Site Planted (Phase II)
October 1999	Vegetation Monitoring (1 yr.)
March-December 2000	Hydrologic Monitoring (2 yr.)
August, October 2000	Vegetation Monitoring (2 yr.)
March-December 2001	Hydrologic Monitoring (3 yr.)
July 2001	Vegetation Monitoring (3 yr.)
March-December 2002	Hydrologic Monitoring (4 yr.)
September 2002	Vegetation Monitoring (4 yr.)

1.4 Debit Ledger

Pembroke Creek Mitigation Site has provided mitigation for several highway projects. Table 1 shows the projects that this site is providing mitigation for since completion.

Table 1. Pembroke Creek Mitigation Site Debit Ledger

Pembroke Creek I	Mit. Plan		TIP DEBIT	TIP DEBIT
Chowan				
Habitat	Acres at Start:	Acres Remaining	R-2512A/Bmod	
SPH Restoration	4.725	0	4.725	
TOTAL	4.725	0		
Pembroke Creek II	Mit. Plan		TIP DEBIT	TIP DEBIT
Chowan				
Habitat	Acres at Start:	Acres Remaining	R-2512 B mod	R-2404C
SPH Restoration	4.949	0	2.6	2.349
TOTAL	4.949	0		

Figure 1. Site Location Map



2.0 HYDROLOGY

2.1 Success Criteria

In accordance with federal guidelines for wetland mitigation, a site meets hydrologic criteria if it is inundated or saturated (within 12" of the surface) by surface or ground water for at least 12.5% of the growing season. However, discussions between NCDOT and natural resource agencies have determined that, due to the unique character of this site, the normal guidelines for hydrologic success may not apply. Groundwater levels may vary significantly on a daily basis due to a sandy substrate that is in close proximity to a tidally influenced body of water.

The growing season in Chowan County begins March 13 and ends December 1. These dates correspond to a 50% probability that air temperatures will drop to 28° or lower after March 13 and before December 1.¹ Thus the growing season is 262 days; optimum wetland hydrology requires 12.5% of this growing season, or 32 days. The site must also experience average climatic conditions in order for the hydrologic data to be considered valid.

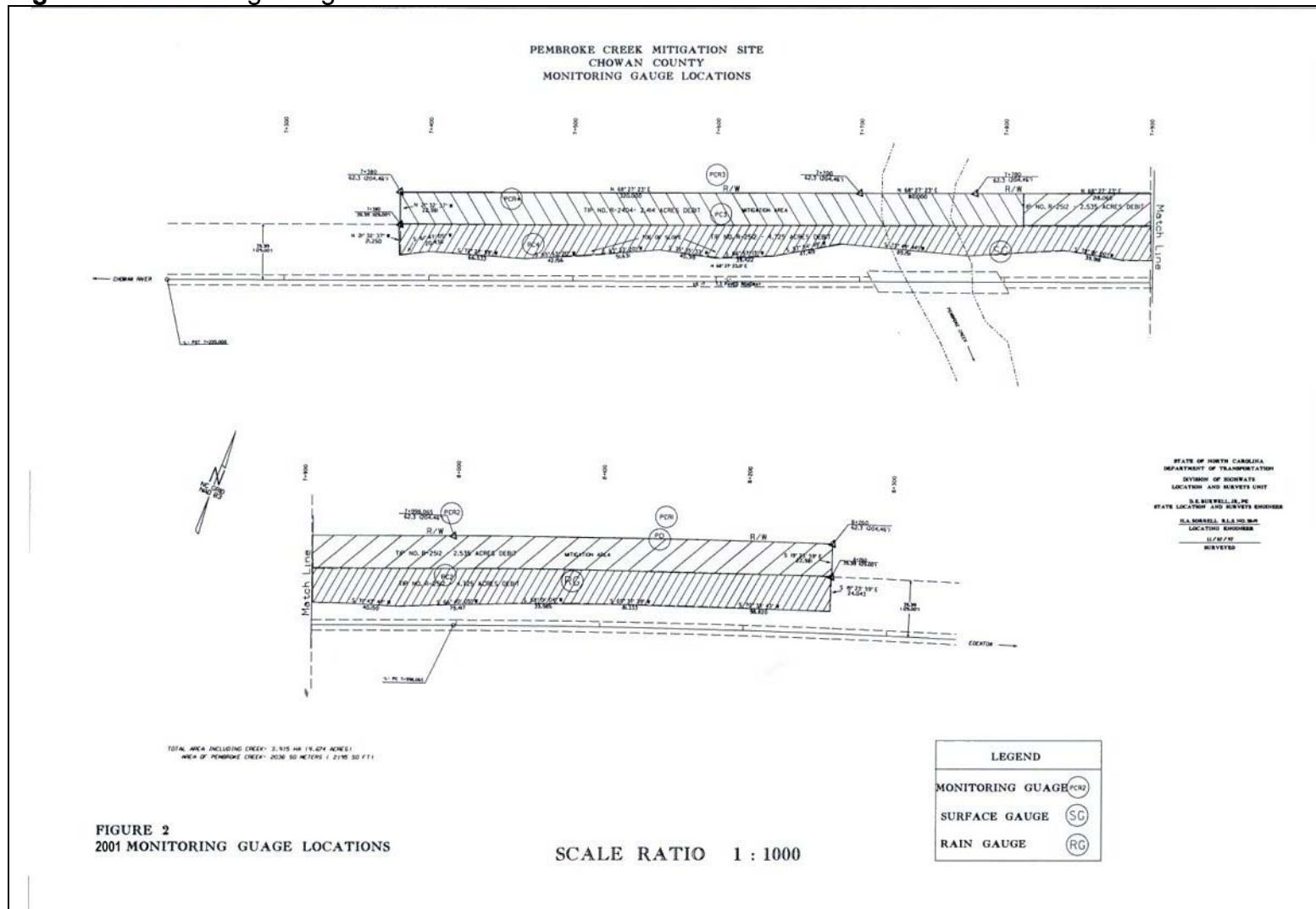
2.2 Hydrologic Description

Eight monitoring gauges (four site gauges, four reference gauges), one rain gauge, and one surface water gauge were installed onsite in February 1999; monitoring began in March 1999 (Figure 2). The automatic monitoring gauges and rain gauges record the depth to groundwater and rainfall, respectively. Data was collected on a daily basis throughout the growing season.

Appendix A contains a plot of the water depth for each monitoring gauge and surface water gauge in 2002. Precipitation events are included on each graph as bars.

¹ Soil Conservation Service. Soil Survey of Chowan and Perquimans Counties, North Carolina, p.76.

Figure 2. Monitoring Gauge Locations



2.3 Results of Hydrologic Monitoring

2.3.1 Site Data

The maximum number of consecutive days in which the groundwater was within twelve inches of the surface was determined for each gauge. The number of days was then converted into a percentage of the 262-day growing season. Table 2 gives the results for the 2002 growing season (March 13-December 1).

Table 2. Hydrologic Monitoring Results

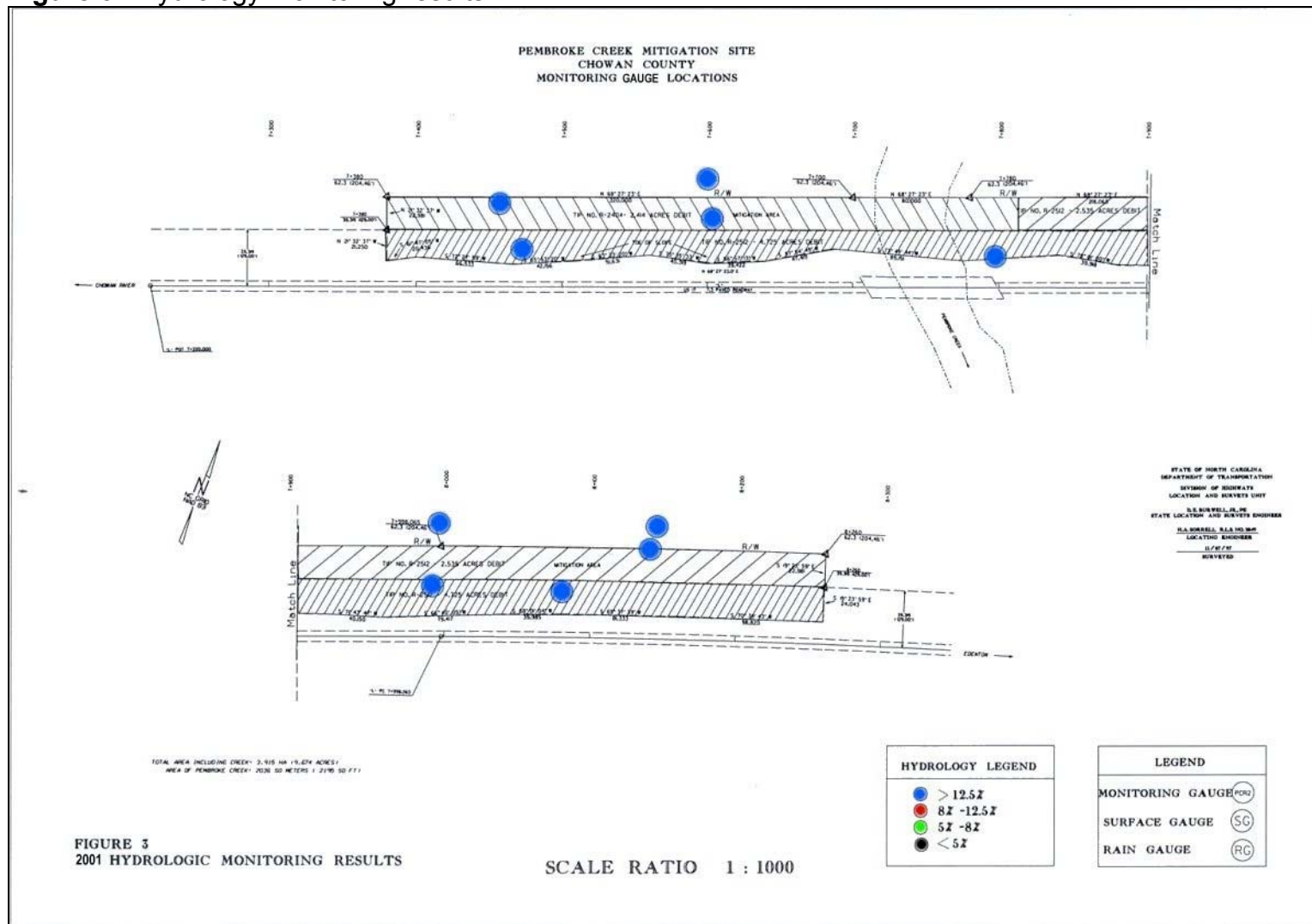
Monitoring Gauge	< 5%	5% - 8%	8% - 12.5%	> 12.5%	Actual %	Dates of Success
PC-1				✓	100%	Mar 13- Dec 1
PC-2				✓	25.19%	Sept 27- Dec 1
PC-3				✓	100%	Mar 13- Dec 1
PC-4				✓	100%	Mar 13- Dec 1
PCR-1 *				✓	100%	Mar 13- Dec 1
PCR-2 *				✓	100%	Mar 13- Dec 1
PCR-3 *				✓	100%	Mar 13- Dec 1
PCR-4 *				✓	100%	Mar 13- Dec 1

* -Reference gauge

Only one problem was reported with the monitoring gauges during 2002. Gauge number S213DE7 (PCR-2) has read 1.1 consistently since March 2002. There was no evidence of standing water present at this gauge location, however the ground appeared to be spongy. Figure 3 is a graphical representation of the hydrologic monitoring results.

All but one of the gauges indicated saturation/inundation for the complete growing season. Thus all but gauge PC-2 have indicated success by showing groundwater levels within 20% of the levels present in the reference areas. In addition, all of the gauges have shown jurisdictional success by recording groundwater levels within 12 inches of the surface for at least 12.5% of the growing season.

Figure 3. Hydrology monitoring results



2.3.2 Climatic Data

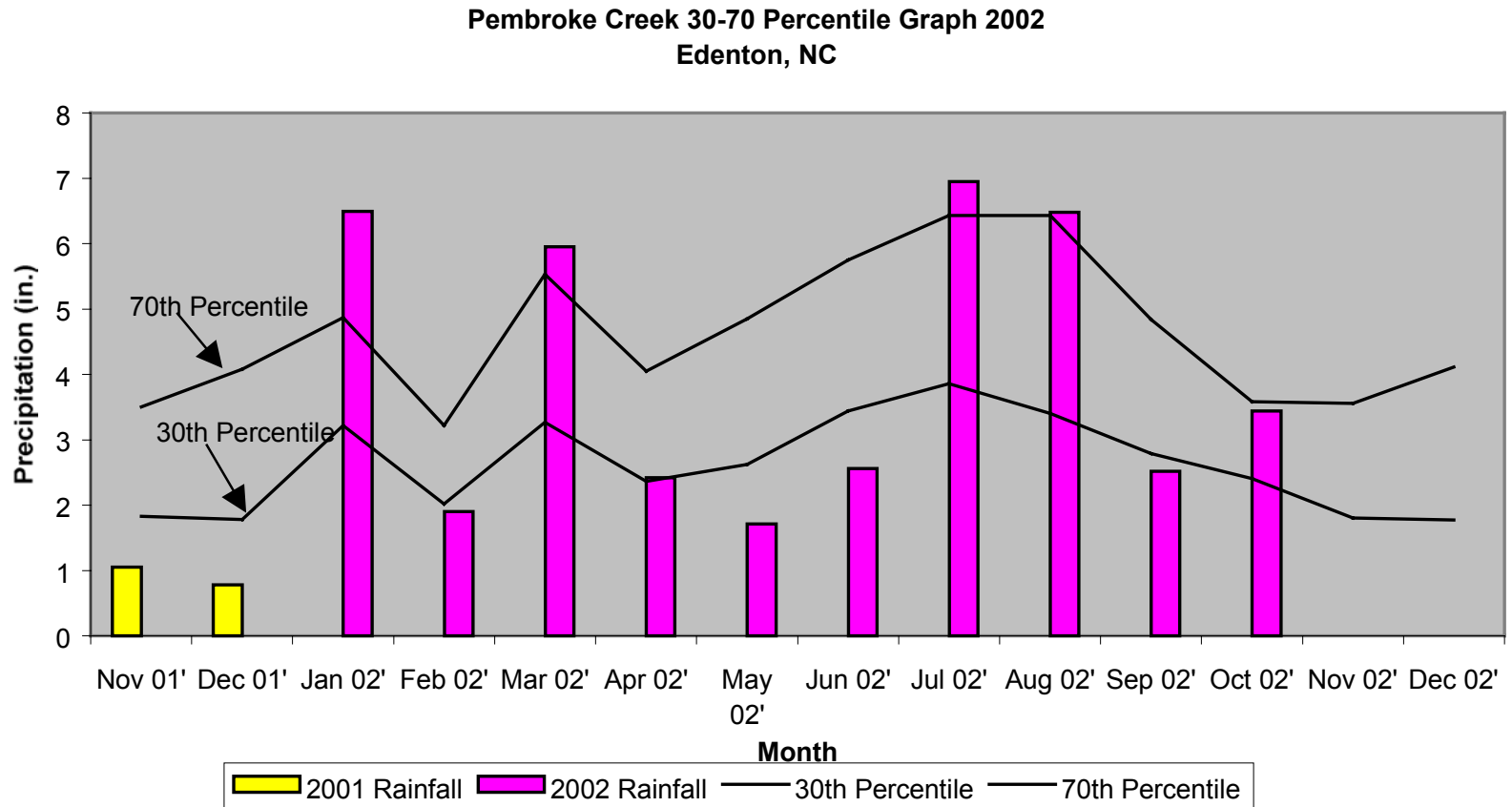
Figure 4 is a comparison of 2002 monthly rainfall to historical precipitation for the Edenton area. Rainfall data recorded onsite during the growing season was compared to the historical 30-70 percentile trends for the area. It is assumed that if the 2002 rainfall totals, represented by bars, fall between the average precipitation values for each month, then the local climate was experiencing average conditions for that particular region.

As indicated by Figure 4, the months of January, March, July and August received above average rainfall. However, every other month except for October saw less than average rainfall. Thus the site was saturated during below average climate conditions.

2.4 Conclusions

The monitoring results indicate that the site is successful by jurisdictional standards, even in below average climate conditions. Only one of the four gauges did not show a groundwater level within 20% of the level in the reference wetland. This same gauge was also the only one that did not show saturation for the entire growing season. This gauge will be checked for any problems as well as any underlying circumstances that would cause the gauge not to show the same saturation as the other gauges. Hydrologic monitoring will continue in 2003.

Figure 4. Historical Rainfall Data (30-70 Graph)



3.0 VEGETATION

3.1 Success Criteria

Success Criteria states that there will be a minimum density of 320 trees per acre of approved target species surviving for at least three consecutive years.

3.2 Description of Species

The following tree species were planted in the Phase I Restoration Area:

Zone 1: (0.854 HA)

Chamaecyparis thyoides, Atlantic White Cedar
Taxodium distichum, Baldcypress

Zone 2: (0.327 HA)

Nyssa aquatica, Tupelo Gum
Fraxinus pennsylvanica, Green Ash
Quercus lyrata, Overcup Oak
Taxodium distichum, Baldcypress

Zone 3: (0.468 HA)

Taxodium distichum, Baldcypress
Nyssa aquatica, Tupelo Gum
Nyssa sylvatica var. *biflora*, Swamp Blackgum
Fraxinus pennsylvanica, Green Ash

Phase II was planted in the winter of 1998-99. The following tree species were planted in the Phase II Restoration Area:

Zone 1: (0.88 HA)

Chamaecyparis thyoides, Atlantic White Cedar
Taxodium distichum, Baldcypress

Zone 2: (0.35 HA)

Nyssa aquatica, Tupelo Gum
Fraxinus pennsylvanica, Green Ash
Quercus lyrata, Overcup Oak
Taxodium distichum, Baldcypress

Zone 3: (0.8 HA)

Taxodium distichum, Baldcypress
Nyssa aquatica, Tupelo Gum
Quercus lyrata, Overcup Oak
Fraxinus pennsylvanica, Green Ash

3.3 Results of Vegetation Monitoring

	Plot #	Baldcypress	Atlantic White Cedar	Green Ash	Overcup Oak	Tupelo Gum	Swamp Blackgum	Total (4 years)	Total (at planting)	Density (Trees/Acre)
ZONE 1	1	24	3					27	28	656
	6	13	3					16	33	330
ZONE 1 AVERAGE DENSITY										493
ZONE 2	2			18	4	8		30	30	680
	5	1		14	10	7		32	37	588
ZONE 2 AVERAGE DENSITY										634
ZONE 3	3	10				6	4	20	30	453
	4	21	1		5	7	1	35	43	553
ZONE 3 AVERAGE DENSITY										503
TOTAL AVERAGE DENSITY										543

Site Notes: Other species noted: cattail, woolgrass, arrowhead, phragmites, *Eleocharis* sp., *Juncus effusus*, red maple, black willow, *Polygonum* sp., *Carex* sp., briars, fennel, *Baccharis* sp., sycamore, jewelweed, and smartweed.

3.4 Conclusions

The 2002 vegetation monitoring revealed an average density of 493 trees per acre for Zone 1, 634 trees per acre for Zone 2, 503 for Zone 3, and 543 trees per acre for the site's average. All densities are well above the minimum of 320 trees per acre required by the success criteria.

NCDOT will continue vegetation monitoring at the Pembroke Mitigation Site.

4.0 OVERALL CONCLUSIONS/ RECOMMENDATIONS

The Pembroke Creek Mitigation Site was monitored for the fourth year in 2002. Both hydrologic and vegetation conditions were monitored. The hydrologic data indicates that the site is meeting success both by jurisdictional standards as well as those set forth in the original plan. Only one gauge (PC-2) did not show groundwater levels within 20% of its associated reference gauge; this same gauge was the only one that did not show saturation for 100% of the growing season.

Vegetation monitoring for the site revealed that all three planting zones met the minimum requirement for tree survival, with the overall site having a 543 trees per acre survival average.

Based upon the results of the fourth year of monitoring data, NCDOT will continue monitoring the Pembroke Creek site for a fifth year.

APPENDIX A
DEPTH TO GROUNDWATER PLOTS

APPENDIX B
SITE PHOTOS & VEGETATION PLOTS

Pembroke Creek



Photo 1



Photo 2

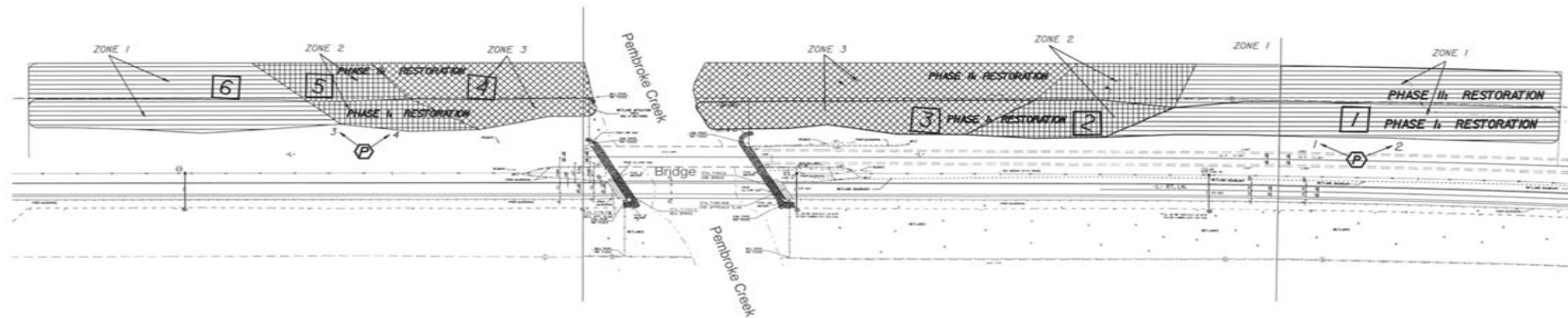


Photo 3



Photo 4

Pembroke Creek
Mitigation Site
Planting Plan, Plot Locations, and Photo Locations



□ Plot Locations

Ⓟ Photo Locations